the efficiency of the shooting is far from having been demonstrated to the satisfaction of every one and our object is precisely to prove it to all.

During the past year, two particularly interesting communal organizations have been formed in France: (1) At Denicée (by Messrs. Guimand and Blanc) where 52 cannon have been placed about 500 meters apart, in such manner as to form a regular defense over the whole surface of the commune, the geometrical outline of which is almost that of a rectangle twice as long as broad; (2) at Saint-Gengoux-le-National and Burnand, where the attempt has been made to place the cannon along the ordinary trajectory of the thunderstorms. In the north of Italy, a certain number of excellent installations have been made according to the same principals.

The Denicée type, for example, would have to be developed, and it would be advantageous to organize a regular continuous defense over a territory sufficiently vast in proportion to the area covered by the storms, and comprising a group of as many contiguous communes as possible. This has already been done by Mr. Chatillon, in the region of Beaujolais; he has established 18 shooting stations with a total of 340 cannon and covering an area of 10,000 hectares. There should in addition be selected other communal groups without cannon, but presenting about the same agricultural and topographical conditions as the preceding, and thus, by a simple comparison, it would be seen whether the storms in general behave any differently in the two groups of communes. This, of course, would not prevent the ordinary observations from being made.

The Saint-Gengoux type lends itself to a still more interesting modification. Suppose that it should be desired to make an application of this type in the department of the Rhone, which would be perfectly appropriate for the purpose, by reason of its extent, its geographical position, its topography, the serious damage that it sustains each year, and also on account of the cannon that are already established there.

In this department, as also in many others, the storms move in general from the west-southwest to the east-northeast, or perhaps rather from the southwest to the northeast. If the defense were organized by multiplying the cannon in that direction, and consequently diminishing the number in the other directions, the habitual limited breadth of the storms would cause them to pass nearly always either to the right or the left of the line of defense; they would touch it lightly sometimes, but would rarely reach it completely. The action of the cannon would then, however, be very difficult to interpret, and one would often be exposed to unfortunate illusions, and sources of error that would seriously diminish the value of the experiments.

On the other hand, these grave defects could be avoided by extending the line of defense over a long strip of territory which should be perpendicular to the ordinary direction of progression of the storms. This strip of country might be of any desired width, but should above all be quite long in order that a large part of the storms should be obliged to cross it. Thus good comparisons would be obtained between the effects produced by the storms in this protected strip, and those that they caused before they encountered the cannon, and after they passed them.

Many improvements will still be introduced into the methods of protection from hail, by experienced persons who have directed the former experiments. But there is one fault that they should carefully avoid falling into, namely, that which would result from the dissipation of our energy. It would be puerile and injurious to multiply incomplete organizations which would do no good and would conduce to discouragement. At present, all efforts should be directed to a single end—to proving in an irrefragable manner the efficacy of cannon shooting against hail; and for this purpose it is necessary to accumulate well authenticated facts. The enthusiasm that you have manifested proves to me that it is not necessary for me to bid you be of good courage. To the work then, and let us hope for victory.

WEATHER BUREAU MEN AS INSTRUCTORS AND LECTURERS.

We print herewith the outline of a course in climatology that is being given by Mr. A. E. Hackett, Section Director, Columbia, Mo., to students in the University of Missouri.

With regard to the method of instruction, Mr. Hackett says:

In making the various charts the data is read by the instructor and copied upon blank maps by the students, the isotherms and other lines being drawn during the week.

A 15-minute quiz is given each week upon the charts and lecture of the preceding week.

A FOURTEEN WEEKS' COURSE IN CLIMATOLOGY.

[Confined to a study of the climate of the United States.]

FIRST WEEK.

Lecture.—How the atmosphere is heated; brief reference to the principles of conduction, convection, radiation, and reflection, the amount of solar heat received by the Northern Hemisphere at different seasons of the year, different effects upon land and water surfaces, diurnal fluctuations of temperature, effects of ocean currents and large bodies of water upon the temperature of adjacent lands, effects of altitude, prevailing winds, etc., conduction of heat in soil; *how the temperature of the air is measured; how the normal temperature for any place is obtained.*

SECOND WEEK.

Chart work.—Annual mean temperature of the United States.

THIRD WEEK.

Chart work.—Normal temperatures for January and July. A chart showing amplitude, to be made during the week.

FOURTH WEEK.

Chart work.—Highest and lowest temperatures on record. A chart showing extreme range of temperature, to be made during the week.

FIFTH WEEK.

Chart work.—Annual curves of temperature at selected stations; comparing the seasonal march of temperature in different sections of the country.

SIXTH WEEK.

Chart work.—Annual curves of temperature at selected stations.

Lecture.—Causes of differences in annual curves.

SEVENTH WEEK.

Chart work.—Continuance of daily mean temperature above 50° and below 32°.

EIGHTH WEEK.

Chart work.—A series of three charts illustrating the progressive movement of cold waves; remarks by the instructor.

NINTH WEEK.

Chart work.—Average annual precipitation in the United States.

Lecture.—Effects of prevailing winds and mountain ranges upon precipitation; how precipitation is measured; excessive precipitation, etc.

TENTH WEEK.

Chart work.—Seasonal precipitation (four charts, the average seasonal precipitation being entered for each State).

ELEVENTH WEEK.

Chart work.—Average number of rainy days for the year. Normal relative humidity.

Lecture.—What is meant by "relative humidity;" how humidity observations are made.

TWELFTH WEEK.

Chart work.—Average seasonal snowfall and average cloudiness.

Lecture.—How snowfall is measured; water equivalent to snow; importance of snowfall in subarid regions; extent to which a covering of snow protects the ground from frost.

THIRTEENTH WEEK.

Chart work.—Average dates of first and last killing frosts.

Lecture.—How frost is formed; methods of protection from frost.

FOURTEENTH WEEK.

Lecture.—Comparison of temperature and rainfall of the United States with that of other countries of the globe, illustrated by charts.

At Buffalo, N. Y., on January 8 and 10, the class in physics from the local high school, and on January 25 the physical geography class from the high school at North Tonawanda, N. Y., visited the Weather Bureau office. The theory and use of the various meteorological instruments, the construction of weather maps, and other features of the work of the office were explained to the students by Local Forecaster David Cuthbertson, who considers these official visits of more practical value to the students than formal lectures at the school.

At Indianapolis, Ind., on January 11, the physical geography class of the Shortridge High School, and on January 23 the pupils of grade 8A, from public school No. 8, visited the Weather Bureau office. Section Director W. T. Blythe explained the various meteorological instruments, and the manner in which observations are made, collected, and charted, so as to be available for forecast and study purposes.

Mr. F. H. Clarke, Local Forecast Official, Scranton, Pa., reports that he has delivered addresses before farmers institutes in Pennsylvania, as follows: December 5, 1901, at Montrose, Susquehanna County; December 6, 1901, at Madisonville, Lackawanna County; December 7, 1901, at Clarks Summit, Lackawanna County; December 13, 1901, Factoryville, Wyoming County; December 20, 1901, at Waymart, Wayne County; January 6, 1902, at Weatherly, Carbon County; and on January 11, 1902, at Sciota, Monroe County.

Mr. Clarke outlined very briefly the method by which weather information is collected for use at the various Weather Bureau offices in making daily forecasts, and urged upon the the farmers the importance of keeping a record of local weather signs, or changes in wind direction, cloud forms, etc., that precede changes in the weather, to supplement the forecast issued by the Weather Bureau.

Mr. J. Warren Smith, Section Director, Columbus, Ohio, delivered an address, illustrated with stereopticon views, in the auditorium of the high school, Mount Vernon, Ohio, on January 24. The account of the lecture that appeared in the Mount Vernon Daily Banner of January 25 indicates that Mr. Smith covered a wide field in his lecture, "Mountain meteorology," "Meteorology in the arctic regions," and "The sections of the globe having the highest and lowest temperature" being discussed, as well as the instruments and methods employed by the United States Weather Bureau in its work. The conditions that produce thunderstorms, tornadoes, rain, snow, and hail were also explained, and the destructive effects of hurricane winds were shown by means of views.

Mr. Charles Stuart, Observer, Spokane, Wash., lectured before the faculty and students of the Washington State Agricultural College at Pullman, on January 29, on "Weather changes and their causes." A barometer was exhibited and explained.

Mr. Charles E. Linney, Observer, Chicago, Ill., spoke before the Cook County Farmers Institute at Chicago Heights on January 31, his subject being "The Weather Bureau and how to use it." The history of the development of the Weather Bureau was outlined, the various phases of its forecast work explained, and also the manner in which these forecasts could be made most useful. Charts were used showing the development and progress of typical storm areas, and a few meteorological instruments were displayed.—*H. H. K.*

THE WEATHER OF THE MONTH.

By Prof. ALFRED J. HENRY, in charge of Division of Records and Meteorological Data.

CHARACTERISTICS OF THE WEATHER FOR JANUARY.

From the 1st to the 20th mild, pleasant weather prevailed; thereafter, especially during the closing days of the month, much rain, sleet or snow, and stormy weather were experienced in the lower Mississippi and lower Ohio valleys and generally east of the Appalachians.

The month, as a whole, may be characterized as warm and dry, there being but two important exceptions, viz, (1) the temperature was below the average in Florida, the east Gulf, and South Atlantic States, and (2) the precipitation was above the seasonal average in Arkansas, Kentucky, and locally in the lower Lake region.

There were no unusually severe cold waves.

In connection with the general character of the weather of the month, attention is called to the fact that from the 1st to the 20th the lows moved across the country along the northern boundary, and that pressure over the interior and southern districts was relatively high. It has been noticed in previous years that mild, pleasant weather is almost invariably associated with high pressure to the southward and a movement of lows along the northern circuit. It is not often, however, that such a condition persists as long as three weeks. This type, if we may call it such, was followed on the 19th by a southerly type, and the latter persisted until the end of the month.

PRESSURE.

The distribution of monthly mean pressure is shown graphically on Chart IV and the numerical values are given in Tables I and VI.

Chart III presents for the first time the monthly mean values reduced to sea level under the Bigelow system of reductions, which went into effect on January 1, 1902. The important feature on Chart IV is the great ridge of high pressure extending northwestward from the south Atlantic coast to the